mini-Cab Leakage Tester

Compact, Lightweight Equivalent Body Hole Size Testing Device

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WARNING: Mini CLT is capable of generating ±2500 Pa of Pressure. Please take care when testing very ait tight volumes.

- Supplied fully calibrated, with pre connected instrument, ready to use with minimal setup required.
- Intuitive to use, the detachable hand held gives direct readouts of Test Static Pressure and an Equivalent Body Hole Size or Flow Leakage Rate with accuracies of ±1% & ±2.5% of reading (± 1 digit) respectively.
- The entire 8 – 165l/s range is covered by three Nozzles covered by ISO5801:2007
- Automatically controls pressure throughout the test period in both Positive and Negative Test modes.
- Virtually maintenance free with a rapid low cost, no hassle recalibration service available
- At 19kg it is suitable for a one man lift and fits neatly in boot of most hatchbacks cars
- A high quality, robust design utilising conical inlet nozzle technology for airflow measurement
- Data output to SD flash card or to USB

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1. Introduction

The mini – Cab Leakage Tester (mini CLT) is a low cost, very compact, light-weight and totally self-contained Equivalent Body Hole Size (EBHS) testing device based on a fundamental device, 'The Conical Inlet Nozzle'. It has been designed for use in the automotive industry to measure the air tightness of cabin volumes under both Positive and Negative pressure.

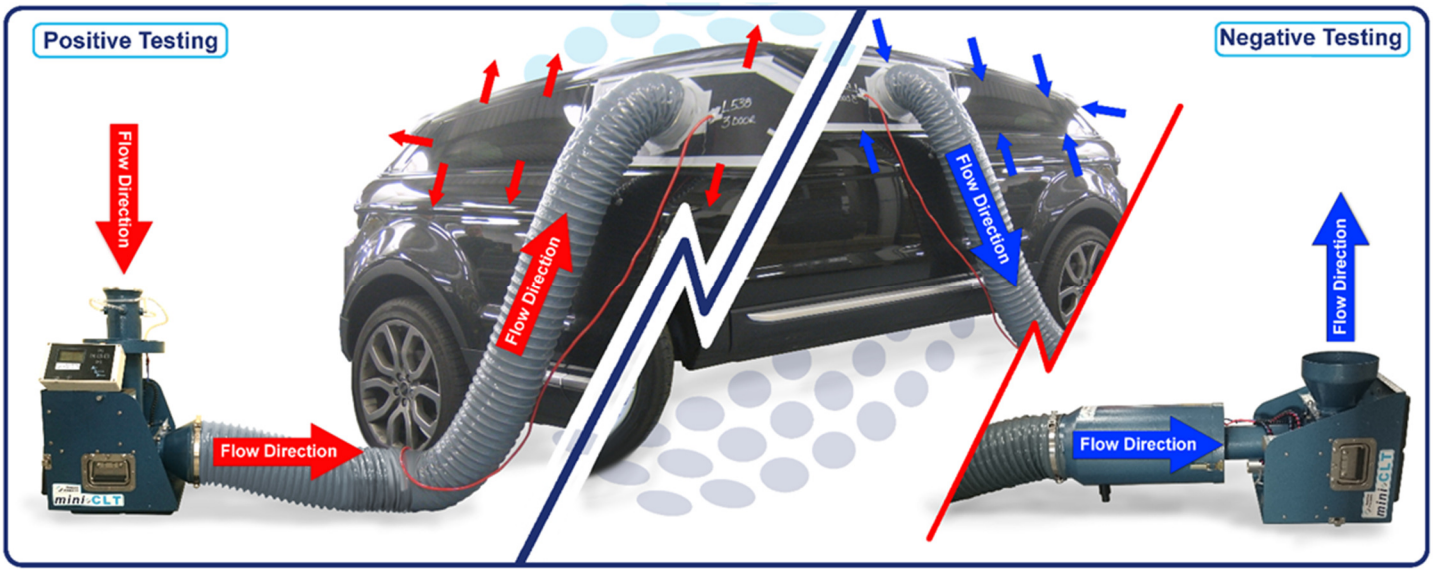
Mini CLT has a high specification and is supplied fully calibrated and complete with everything required to carry out cabin leakage testing, straight from the box. With its lightweight, compact design it is suitable for a one man lift and fits neatly in boot of most small hatchbacks cars.

With the menu driven detachable handheld instrument it has been made intuitive to use and gives highly accurate direct readouts of Test Static Pressure and EBHS or the Measured Leakage Flow Rate. This data is recorded directly onto the on-board SD card or via the USB link onto a computer. Virtually no maintenance of the unit is required and a low cost, no hassle, rapid recalibration service is available.

2. How it works

Before operation the volume being tested is connected to the mini CLT using the ø200mm flexible ducting and the volume adaptor provided. The volume adaptor is also connected to the unit via its integral static pressure tapping and pressure tubing provided. The fan is then switched on to create a pressure within the volume.

There are two ways of pressure testing a volume; **Positive** leakage testing, in which the flexible ducting is attached to the **Outlet** side of the fan, allowing the volume to be pressurised and **Negative** leakage testing**, i**n which the flexible ducting is attached to the negative plenum which is in turn connected to the **Inlet** side of the fan allowing the volume to be depressurised.



Any leakage in or out of the volume has to be compensated for by the fan in order to maintain the static pressure. The fan speed will be adjusted automatically in Auto Mode but can also be adjusted manually by the user. The volume flow rate of the fan will therefore be equal to the leakage rate from the volume.

The pressure displayed on the instrument is the Static Pressure, which is the difference between the pressure in the volume (measured via the volume adaptor pressure tapping) and atmospheric pressure (measured within the instrument). The fan speed can be adjusted until the predetermined test static pressure is reached, at which point the EBHS or the Leakage Rate can be observed.

Mini CLT's function relies on the rules followed by Conical Inlet Nozzles. These are sited on the fan inlet and have a defined relationship between the volume flow rate and the pressure developed at the throat of the nozzle. Mini CLT's instrumentation consists of two electronic manometers, one which measures the static pressure and the other measures the Inlet Nozzle throat pressure. Therefore mini CLT is able to measure this pressure and calculate the Volume Flow rate passing through the selected Conical Inlet Nozzle and therefore calculate the precise Leakage Rate and the EBHS.

This allows an engineer determine whether the volume is a pass or fail. If required the leaks can be located and sealed and the mini CLT will monitor progress as the leaks are sealed. As leaks within the volume are located and sealed, the pressure within the volume will build above the predetermined static pressure. When set in Auto mode the instrument will adjust the fan accordingly, however in manual mode the operator will have to make adjustments to the fan speed to ensure the static pressure is maintained to the correct level as the Leakage Rate decreases.

3. Nozzles

Mini CLT come complete with three interchangeable Nozzles to cover the full leakage range of 8l/s to 165l/s.

Ø28.5mm Nozzle - 8 l/s to 60 l/s
Ø56mm Nozzle - 40 l/s to 100 l/s
Ø90mm Nozzle - 80 l/s to 165 l/s

The ø56mm and ø90mm nozzles comply with ISO 5801:2004 and the ø28.5mm Nozzle, has been specifically manufactured to the same specification and checked using an orifice plate mass flow measuring device.

4. Operation Modes and Data Storage

There are three modes in which mini CLT can be used, Manual Mode, Manual Data Log Mode, Auto Data log Mode and Automatic Mode.

4.1 **Manual Mode** allows the user to monitor both the Pressure and EBHS or Flow Rate. These are then controlled via the fan speed which is manually adjusted by the user. Any results and reading in this mode must be recorded manually by the user. This mode is accessed by selecting Manual Mode form the main menu.

4.1.1 **Manual Data Log Mode** allows a user to log data to the instruments memory by pressing the Enter button whilst in Manual Mode. This Mode is activated by first setting the Data Logging Mode frequency to 00:00 (see Section 6.5).

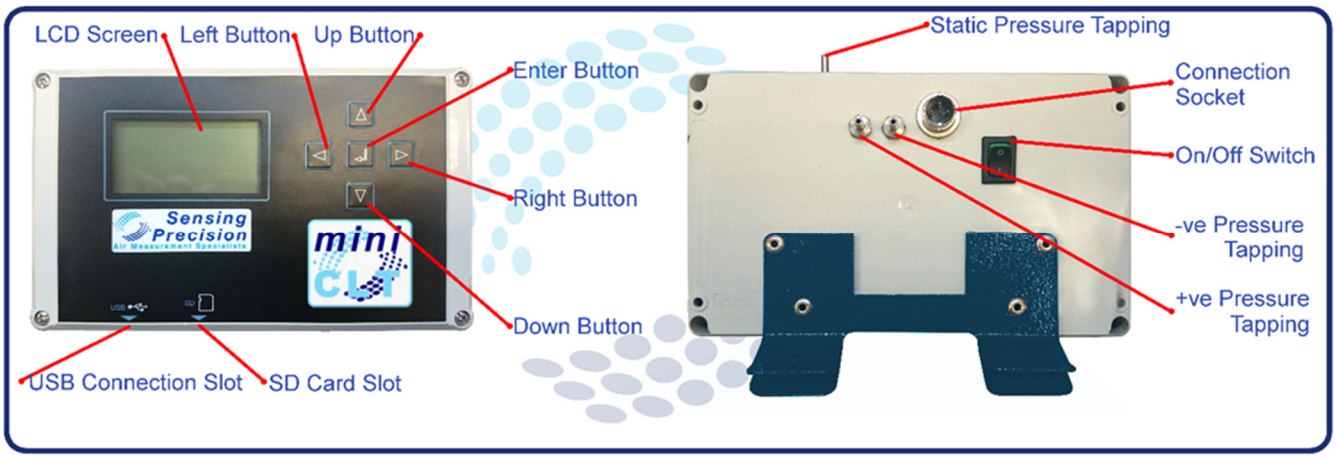
4.1.2 **Auto Data Log Mode** allows a user program the instrument to log data at a predetermined frequency whilst in Manual Mode. This Mode is activated by first setting the Data Logging Mode frequency to any above 00:00 (see Section 6.5). Once in Manual Mode data logging is easily activated and deactivated by pressing the Enter button. Each time this mode is activated the series of results is saved in a new file with date/time references.

4.2 **Automatic Mode** allows a user to automatically log data at a predetermined frequency for a set length of time. In this mode, while the user is sealing leaks and therefore reducing the leakage rate, the instrument will automatically adjust the fan speed to maintain a constant static pressure. This Mode is accessed by selecting Automatic Mode form the main menu.

Data can be saved to the SD card and sent via the USB port to a connected computer and can be accessed via a terminal program. Data sent via the USB port is stored as Tab Delimited data which will need saving as a .txt file before importing into a spreadsheet. Information saved on the SD card is stored in Comma delimited format and can be loaded straight into spreadsheet editing software.

5. Instrument

Mini CLT is controlled using the Instrument. This has been design to be intuitive to use and also very stable. It is recommended that this instrument is returned to Sensing Precision once a year for recalibration.

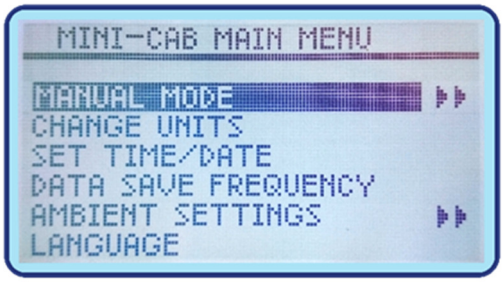


6. Controls

Once the mini CLT has been powered up and the Instrument turned on, it will illuminate with the company loading screen. After approximately 2 seconds, user is taken to the Main Menu.

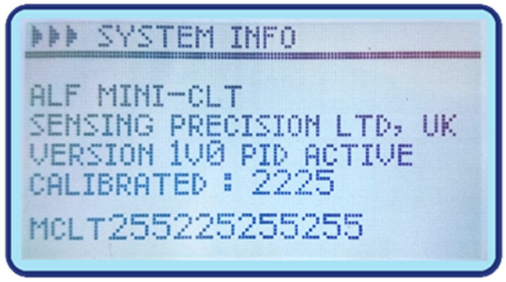
6.1 Main Menu

- The Main Menu is used to navigate between the main options allowing a user to run tests or adjust settings.
- User selects options using the UP and DOWN key and presses ENTER to confirm.
- Using the RIGHT button will allow the user to toggle between Manual/Auto modes and Ambient/Damping settings.



6.2 System Info Screen

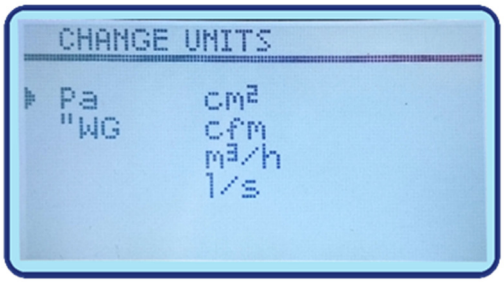
- The System Info Screen displays the system details including when it was last calibrated.
- Pressing LEFT from the Main Menu will take users to system info screen and pressing ENTER will return user to Main Menu.



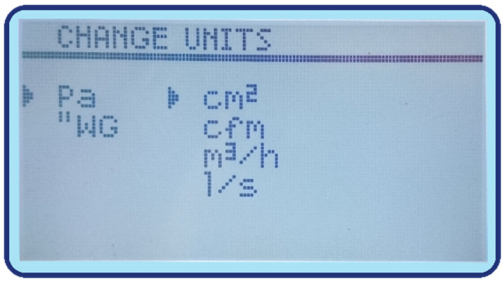
6.3 Select Units

- Select Units allows a user to set their desired units for pressure and then leakage rate.
- Select Units is selected from the Main Menu.
- The user is first able to select the units of pressure using the UP and DOWN keys and presses ENTER to confirm.
- The user is then able to select the leakage units using the UP and DOWN keys and presses ENTER to confirm.

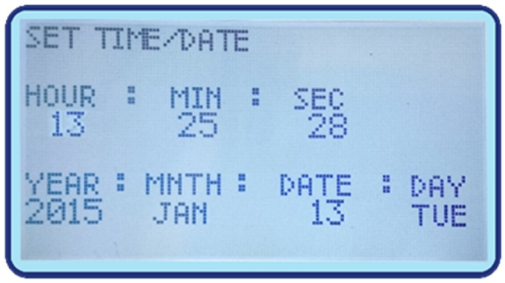
  Once these settings have been confirmed and ENTER pressed the user will be returned to the Main Menu.



Note: If the user selects a unit of Area (cm²) then the EBHS area will be displayed in the test modes, if the user selects a unit of Volume (cfm, m³/h or l/s) then the leakage volume rate will be displayed in the test modes.



6.4 Set Time & Date.

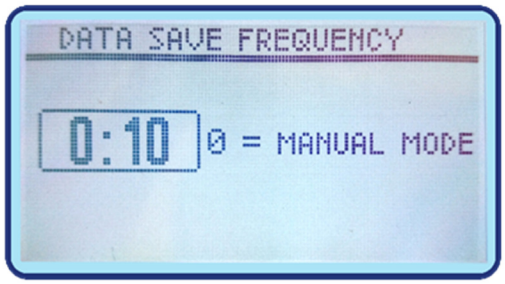


- Set Time & Date allows the user to adjust the time and date.
- Once set, these setting will be indefinitely saved.
- Set Time & Date is selected from the Main Menu.
- User can use LEFT and RIGHT to change fields and UP (only) to edit the selected field.

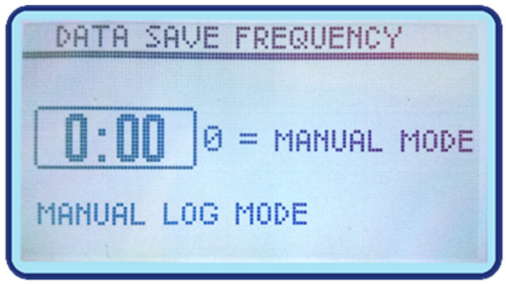
  Once these settings have been confirmed and ENTER pressed the user will be returned to the Main Menu.

Note: Mini CLT automatically corrects for leap years and auto calculates the correct day of the week for the specific date set by the user. It does not currently account for day light savings.

6.5 Data Save Frequency



- Data Save Frequency allows a user to change the frequency at which data is logged, once activated, in test modes.
- The highest selectable frequency is every 1 second, with lowest being every 60 minutes.
- Once the frequency reaches 60 seconds the value will increase in increments of 1 minute only.

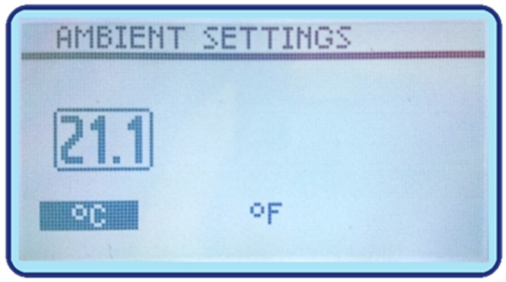


- User selects options using the UP and DOWN key and presses ENTER to confirm.
- If the user sets the frequency to 0 seconds, then Manual Data Log Mode is engaged with manual mode.

  Once these settings have been confirmed and ENTER pressed the user will be returned to the Main Menu.

Note: If the frequency is set to 0 Second and Automatic mode is selected, the frequency will default to 30 seconds.

6.6 Ambient Settings



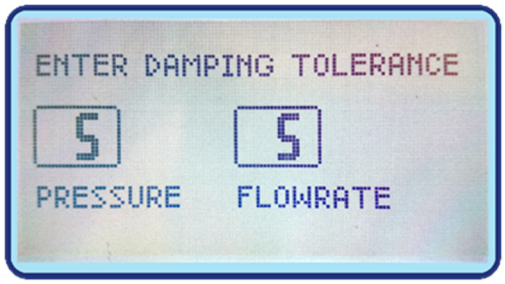
- Ambient settings allows a user to set the current temperature and barometric pressure and the units that they are displayed in.
- Ambient settings is selected from the Main Menu.
- The first screen displayed allows the user to select the temperature and units.
- User edits the temperature using the UP and DOWN and units using the LEFT and RIGHT presses ENTER to confirm.

- The second screen displayed allows the user to edit the barometric pressure.
- User edits the pressure by using the UP and DOWN and units using the LEFT and RIGHT presses ENTER to confirm.

6.7 Sensor Settings

- Sensor Settings allows the user to edit the damping tolerance for the pressure reading.
- User edits the pressure tolerance by using the UP and DOWN key and presses ENTER to confirm.

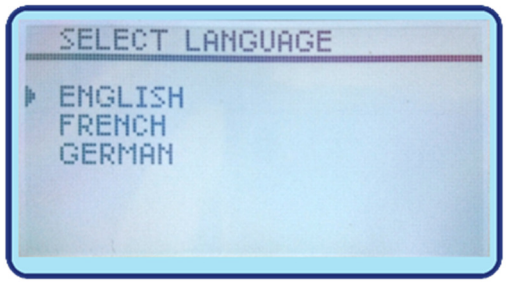
- The user is then prompted to edit the damping tolerance for the flowrate reading.
- User edits the tolerance by using the UP and DOWN key and presses ENTER to confirm



Once these settings have been confirmed and ENTER pressed the user will be returned to the Main Menu.

Note: In both tolerance menus the range is 1 to 15. The lower the number the truer the reading will be to the instantaneous reading and it will appear less stable. The higher the number the more of an average it will be and it will appear more stable.

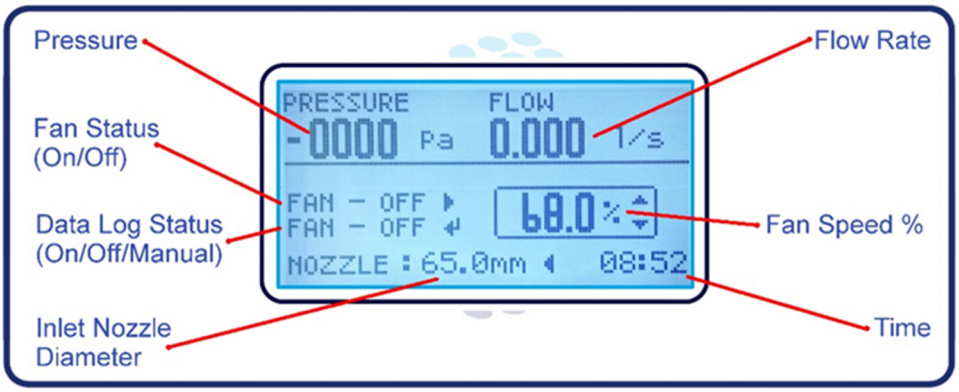
6.8 Language.



- Languages allows a user to change the language in which data is displayed.
- Languages is selected from the Main Menu.
- User selects the language by using the UP and DOWN key and presses ENTER to confirm.

Once these settings have been confirmed and ENTER pressed the user will be returned to the Main Menu.

6.9 Manual Mode Screen (Manual Data Log Mode and Auto Data log Mode)



- Manual Mode allows a user to carry out tests in Manual Data Log Mode and Auto Data log Mode.
- Manual Mode is selected from the Main Menu by selecting Manual Mode and pressing ENTER.
- Once Manual Mode is selected the below actions can be taken.

Button	Action	Operation
LEFT	Press	Changes Nozzles size
RIGHT	Press	Switch fan On/Off
LEFT and RIGHT	Hold	Zero the sensor readings
UP or DOWN	Press/Hold	Increase/decrease fan speed
ENTER	Press	Switch data logging On/Off. (Save data if in Manual Data Log Mode)
ENTER	Hold	Return to Main Menu

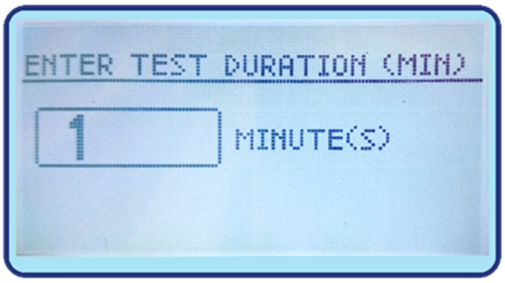
6.10 Automatic Test Screens

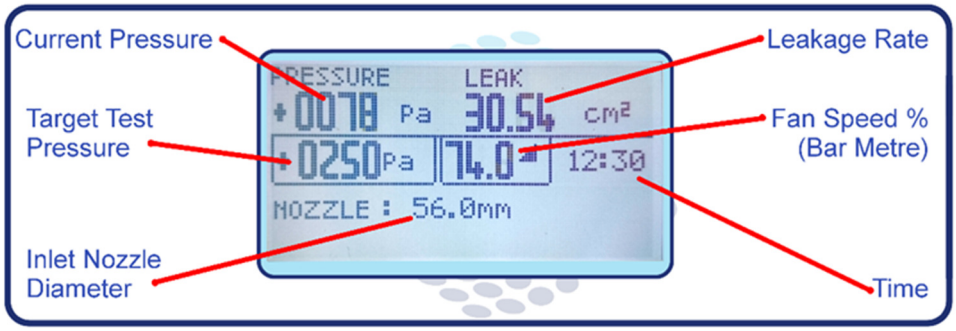
- Automatic Test mode allows a user allows a user to automatically log data at a predetermined frequency for a set length of time.
- Automatic Test Mode is selected from the Main Menu by selecting Automatic Mode from the main menu, this is accessed from selecting Manual Mode, pressing the RIGHT button and pressing ENTER.
- The first screen allows a user to select whether the test is to be carried out in Positive or Negative mode, using the LEFT and RIGHT buttons.
- The required test pressure can also be set using the UP and DOWN buttons. This can also be set whilst the test is running. Press ENTER to confirm.

- The next screen allows a user to adjust the test duration, in minutes.

Note: The last test duration will be saved.

- Upon pressing ENTER the test mode will initiate.

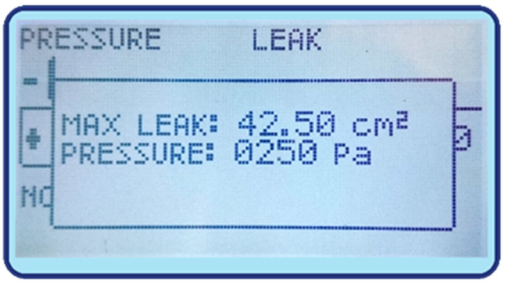




- Once manual mode is selected the below actions can be taken.

Button	Action	Operation
LEFT	Press	Changes Nozzles size
UP or DOWN	Press/Hold	Increase/decrease target test pressure
ENTER	Hold	Return to Main Menu

- The fan will automatically ramp up until the required test pressure is met. The fan speed will be automatically adjusted to keep the test pressure at its required level as the leaks are sealed up.
- Once the test is complete a pop up will appear with the maximum leakage and test pressure.



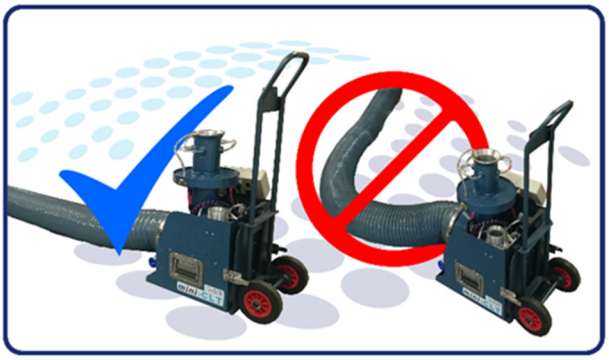
Note: If the test pressure cannot be met with the Nozzle fitted, the instrument will indicated that the nozzle should be changed. The user must hold ENTER to return to the main menu and escape the test.

7. Operator Procedure Prior to Leakage Testing

When first using the mini CLT the following procedure should be adopted before attempting to switch on the Mains Power. However, this is not meant to be a totally comprehensive procedure but will provide a system of checks to maintain the operator's safety and accurate test results.

7.1 Check the power requirement of the mini CLT is in harmony with the mains supply on site and connect to the correct power supply using the lead supplied.

7.2 Position mini CLT so that there is little chance of personnel tripping over the flexible duct, power cable or the static pressure tube when testing.



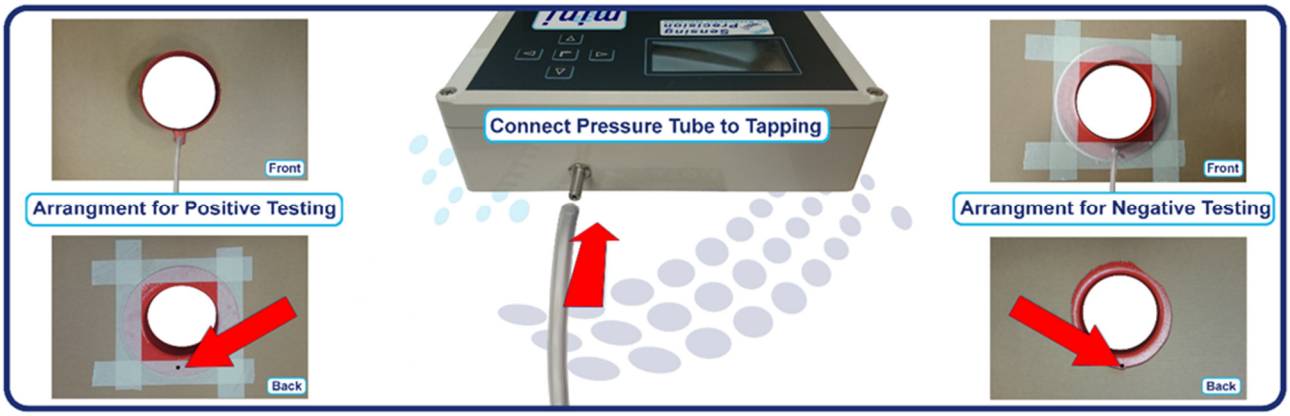
Note: Mini CLT will perform best when the flexible duct is as straight as possible to reduce pressure loss and allows for maximum performance of the system.

7.3 Remove the flexible duct assembly from its storage bag. If a positive test is to be carried out, remove the Plenum and connect the flexible ducting to the fan outlet side. If a negative test is to be carried out, refit the Plenum and attached the flexible ducting to it.

7.4 The adaptor plate, located at the other end of the flexible duct, should now be securely fitted to the volume to be tested. The user must ensure the adaptor has air tight seal and is secure and safe so that it is not detached due to the weight of the flexible duct or by the pressure being applied when testing.

7.5 Ensure the all obvious openings are sealed off.

7.6 The volume adaptor is also connected to the unit via its integral static pressure tapping. The pressure tubing is used to connect it to the corresponding tapping on the instrument.



Note: The user must ensure that the opening for the static pressure tapping is open to the volume being tested and that it is not covered up.

The system is now ready to implement the **Test Procedure for Leakage Testing.**

8. Test Procedure for Leakage Testing in Manual Mode (Manual Data Log Mode and Auto Data log Mode)

The same procedure is followed for both Positive and Negative pressure testing. The only differences are that; if a positive test is to be carried out, the plenum is removed and the flexible ducting is connected to the fan outlet side and if a negative test is to be carried out, the plenum is refitted and the flexible ducting attached to it.

The appliance may require repositioning when switching testing modes and will perform best when the flexible duct is as straight as possible.

WARNING: Mini CLT is capable of generating ±2500 Pa of Pressure. Please take care when testing very ait tight volumes.

8.1 Complete steps detailed within **Procedure Prior to Leakage Testing**.
8.2 Switch the unit ON via the red mains rocker switch sited on the front panel, next to the power inlet. The switch should be illuminated once switch ON**.**
8.3 Switch the ON rocker switch on the rear of the Instrument.
8.4 Upon first using mini CLT it is recommended to first set the correct date and time.
8.5 Set preferred settings (Units, Language, etc…). These setting will be saved from the last time the mini CLT was used.
8.6 Make sure the Data Save Frequency is set to the correct figure to enable Manual Data Logo mode or Auto Date Log mode (see Section 6.5).
8.7 Once all setting are correct Run can be selected.
8.8 Once manual mode Screen appears, ensure fan is switched to OFF on the instrument and that it is stationary.

Note: The fan speed and nozzle size will be saved from the last time the unit was used.

8.9 Zero the instrument.
8.10 Start the fan.

WARNING: Once activated, the fan will ramp up to the speed set on the instrument. It is recommended that on a new test that the fan speed is set low before turning the fan on.

8.11 Increase fan speed until the required static pressure is met (should the required pressure not be achievable or the flow rate is shown to be zero, see Section 10 – Changing Nozzles).
8.12 Check the flexible duct, pressure tubing and connections for leaks.
8.13 The leakage testing can now commence and data logged in one of three ways, manually by the user, Manual Data Log Mode or Auto Data log Mode.
8.14 Should mini CLT only be required to determine the leakage rate of a particular volume, this test would now be complete.

The initial leakage test is now complete. If the leakage rate is to be reduced move to 8.15 or if no further testing is required power down the unit 8.16.

8.15 User locates any obvious leaks and seals them off.

Note: It is recommend that after each leak is sealed the user return to the appliance and return to **8.11**.

8.16 Once the test is fully complete the unit can be powered down and then disconnected.
- **8.16.1** Start by turning off the fan from the instrument.
- **8.16.2** Once the fan has come to rest switch off the instrument.
- **8.16.3** The Main Power switch can now be turned **OFF**.
- **8.16.4** The flexible ducting can now be removed from mini CLT and the volume.

9. Test Procedure for Leakage Testing in Automatic Mode

The same procedure is followed for both Positive and Negative pressure testing. The only differences are that; if a positive test is to be carried out, the Plenum is removed and the flexible ducting is connected to the fan outlet side and if a negative test is to be carried out, the Plenum is refitted and the flexible ducting attached to it.

The appliance may require repositioning when switching testing modes and will perform best when the flexible duct is as straight as possible.

WARNING: Mini CLT is capable of generating ±2500 Pa of Pressure. Please take care when testing very ait tight volumes.

9.1 Complete steps detailed within **Procedure Prior to Leakage Testing**.

9.2 Switch the unit ON via the red mains rocker switch sited on the front panel, next to the power inlet. The switch should be illuminated once switch ON**.**

9.3 Switch the ON rocker switch on the rear of the Instrument.

9.4 Upon first using mini CLT it is recommended to first set the correct date and time.

9.5 Set preferred settings (Units, Language, Data Save Frequency etc…). These setting will be saved from the last time the mini CLT was used.

9.6 It is recommended that an initial test is carried out as per Sections 8.6 – 8.14 to verify that the correct sized nozzle is being used as the Automatic Test will need to be terminated should the nozzle need changing mid test.

9.7 Select Automatic Mode from the Main Menu by first selecting Manual Mode and pressing the RIGHT button and then pressing ENTER.

9.8 Now enter the required test pressure and whether the test is to be carried out in positive or negative mode (the test pressure can be adjusted during the test).

9.9 Now enter the Test duration, the last used duration will still be saved.

9.10 Upon pressing ENTER the test will begin and the fan will ramp up until the required pressure is met.

9.11 User locates any obvious leaks and seals them off.

Note: It is recommend that the user momentarily returns to the instrument to ensure the system has not gone out of range.

9.12 Once the time duration has past and the test has finished the instrument will display the maximum leakage rate and the test pressure and save the data.

Note: Should the required leakage rate be met before the time duration has elapsed the test can be terminated early by holding the ENTER button and the data will be saved.

9.13 Once the test is fully complete the unit can be powered down and then disconnected.

- **9.13.1** Start by turning off the fan from the instrument.
- **9.13.2** Once the fan has come to rest switch off the instrument.
- **9.13.3** The Main Power switch can now be turned **OFF**.
- **9.13.4** The flexible ducting can now be removed from mini CLT and the volume.

10. Changing Nozzles

Within manual mode, if at any time the leakage rate is Zero a smaller nozzle will be required before testing is continued and if the static pressure cannot be reached then the leak is too big and a larger nozzle required.

Within Automatic Mode the instrument will indicate whether the Nozzle needs to be changed

The range for each nozzle is shown in Section 3.

To change a nozzle:

10.1 Turn the fan to OFF via the instrument.

Note: This can be done by pressing the RIGHT button in Manual Mode. In Automatic Mode you will need to Hold the ENTER button to exit the test and deactivate the fan.

10.2 Wait for the fan to become stationary.

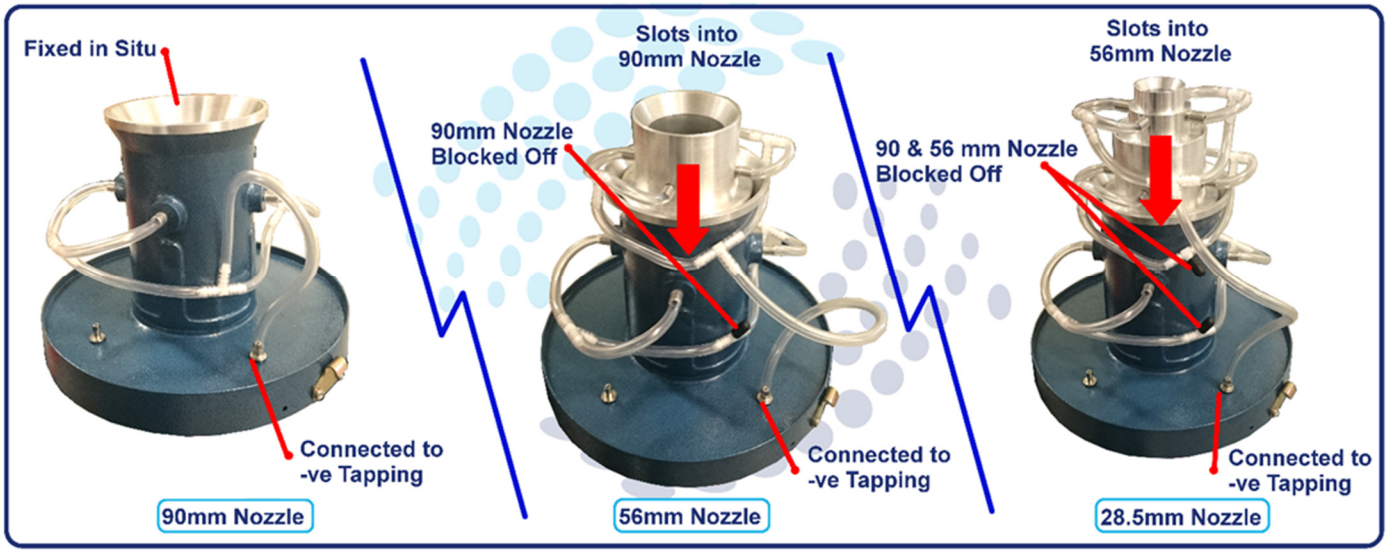
WARNING: Do not change nozzles with the fan running.

10.3 Negative Mode Only – Unclip and remove plenum from fan inlet.
10.4 Remove the in situ nozzle if present and place in nozzle storage clip.
10.5 Insert replacement or use fixed nozzle.

10.5.1 Ø90mm nozzle is permanently fixed to the mini CLT unit – when this nozzle is in use ensure that the Ø90mm nozzle pressure tubing is connected to the Negative tapping on the unit.

10.5.2 Ø 56mm nozzle is inserted into the ø90mm nozzle – when this nozzle is in use ensure that the Ø56mm nozzle pressure tubing is connected to the Negative tapping on the unit and the Ø90mm Nozzle pressure tubing is blocked off.

10.5.3 Ø28.5mm nozzle is inserted into the ø56mm nozzle – when this nozzle is in use ensure that the Ø28.5mm nozzle pressure tubing is connected to the Negative tapping on the unit and the Ø90mm and Ø56mm Nozzle pressure tubing is blocked off.



10.6 Negative Mode Only – Reattach plenum to fan inlet.

Note: In Manual mode you must Zero the instrument before the fan is turned back on. A new test can now be started in Automatic Mode.

11. Routine Maintenance

Routine Checks:

11.1 Check the flexible hose for rips and tears and that it is securely connected to the volume adaptor.
11.2 Check integrity of pressure tubes and their connections to the instrument and nozzle tappings.
11.3 Check power lead for damage
11.4 Check nozzles for dents, chips and large scratches.
11.5 Check O-ring for damage and ensure they are thoroughly lubricated.

12. Service and Calibration

Instrument:

12.1 The Instrument should be returned to Sensing Precision annually for calibration.
12.2 To obtain a quotation to order against please email: sales@sp.gb.com

Nozzles:

12.3 The nozzles are designed and checked against a primary standard at manufacture and therefore they do not require calibration. They should be inspected regularly for any damage as this may affect their performance.
12.4 If you are concerned about the integrity of the Ø56mm or Ø28.5mm replacement nozzles are available from sales@sp.gb.com.
12.5 For the Ø90mm fixed nozzle please refer to the **Full Unit** service section**.**

Full Unit:

12.6 Should the full unit develop a fault or be damaged the unit can be returned to us for service and repair.
12.7 It is recommended that the full unit is returned to us every 3 years for a full inspection and service.

Electrical Safety:

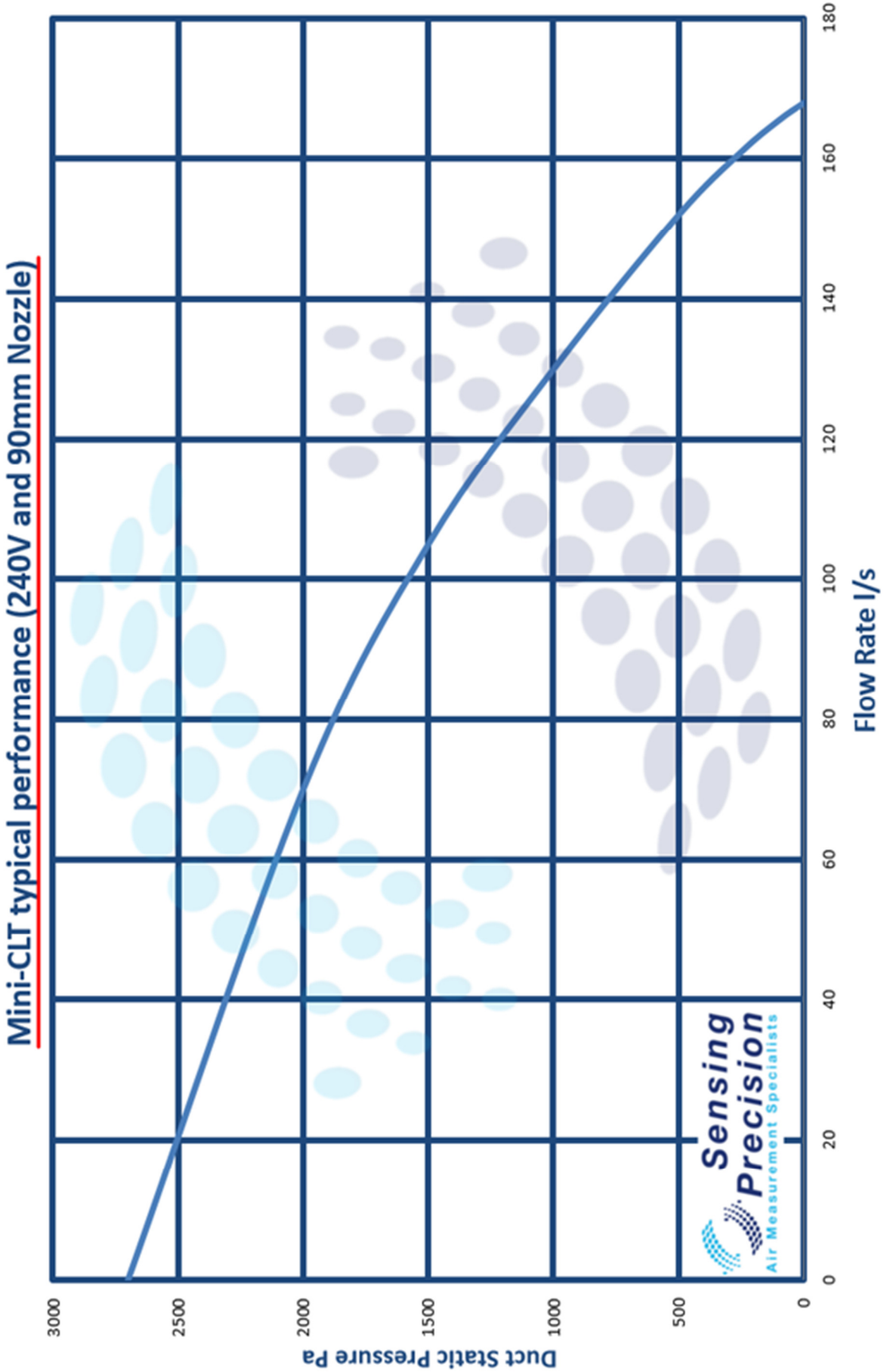
12.8 Both active components within the main unit are internally fused with a non-replaceable device.
12.9 Should incorrect voltage/spikes be applied to the unit or another event occur that causes a fuse to blow, please contact us to arrange repair/replacement of the affected parts.
12.10 No user serviceable parts are contained within the unit and all servicing should be referred to the manufacturer as many connections inside the unit could be at mains potential.
12.11 Electrical cable should be checked regularly for damage and replaced if insulation or plugs/sockets are damaged.
12.12 For optimum safety the unit should be used on an RCD/Earth Leakage protected circuit as well as a sensibly sized over current trip.

Warranty:

12.13 The product is supplied with a two year limited warranty against manufacturing defects and component failure but excludes damage caused through misuse, repair of which will be quoted prior to commencement of work. The warranty is also subject to the recommended service and calibration schedule being followed.

Please contact sales@sp.gb.com *before returning your unit for service or repair & to order Spare Parts.*

13. Performance Curve



14. Specification

Volume Flow Measurement	8l/s to 165 l/s over nozzle ranges
Pressure Measurement Range	±2500 Pa
Typical Duty Point	160l/s at 250Pa
Pressure Measurement Accuracy	± 1% of reading ± 1 digit
Leakage Flow Accuracy	± 2.5% of reading ± 1 digit
Resolution	1Pa
Power	400W
Voltage	230Vac 50/60Hz (or 115Vac 50/60Hz available)
Unit Size	35 (W) x 46 (D) x 68 (H) cm
Unit Weight	19kg
Carry Case (c/w Accessories) Size	45 (W) x 45 (D) x 55 (H) cm
Carry Case (c/w Accessories) Weight	13kg
Clip on Trolley Size	38 (W) x 20 (D) x 94 (H) cm
Clip on Trolley Weight	6.5kg
Optimum Operational Temp.	16 - 24°C
Operational Temperatures	0 - 50°C
Storage Temperatures	-10 - 60°C

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Notes:

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